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## AMS Tracker Thermal Control Subsystem HX\_WireHeater\_Solder\_Procedure

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# AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-

Pag 2 of 15  
Doc. AMSTR-NLR-PR-055  
Issu 01  
Date 25 sept 2008

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# AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-

Pag 3 of 15  
Doc. AMSTR-NLR-PR-055  
Issu 01  
Date 25 sept 2008

## Document change log

<i>Change Ref.</i>	<i>Section(s)</i>	<i>Issue 1.0</i>
-	All	Initial issue

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# AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-

Pag 4 of 15  
Doc. AMSTR-NLR-PR-055  
Issu 01  
Date 25 sept 2008

## Summary

This document describes the Heat eXchanger wire heater solder procedure. The solder procedure is part of the FM/QM HX manufacturing sequence.



# AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-

Pag 5 of 15  
Doc. AMSTR-NLR-PR-055  
Issu 01  
Date 25 sept 2008

## Contents

Document change log	3
Summary	4
1 Scope of the document	7
2 References documents	7
3 Heat eXchanger	8
4 Solder procedure	9
4.1 Materials needed	9
4.2 Procedure description	9
4.3 Wire heater solder procedure in steps	11
END OF DOCUMENT	15



# AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-

Pag 6 of 15  
Doc. AMSTR-NLR-PR-055  
Issu 01  
Date 25 sept 2008

(15 pages in total)



# AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-

Pag 7 of 15  
Doc. AMSTR-NLR-PR-055  
Issu 01  
Date 25 sept 2008

## 1 Scope of the document

The procedure in this document describes the solder procedure of the wire heaters to the FM/QM Heat eXchanger .

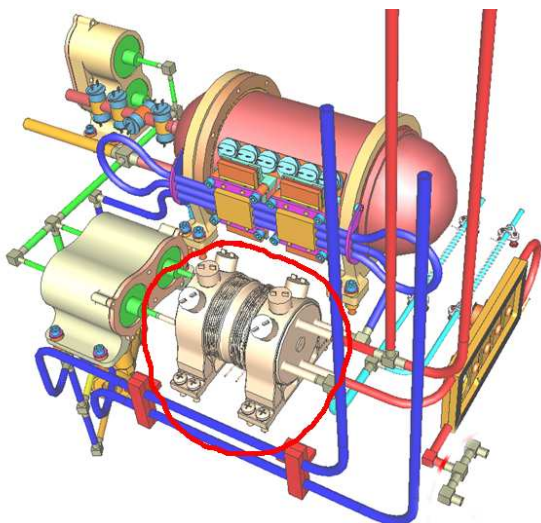
The procedure defines the temperatures and the sequence of steps.

## 2 References documents

	Title	Number	Date
RD-1			
RD-2			

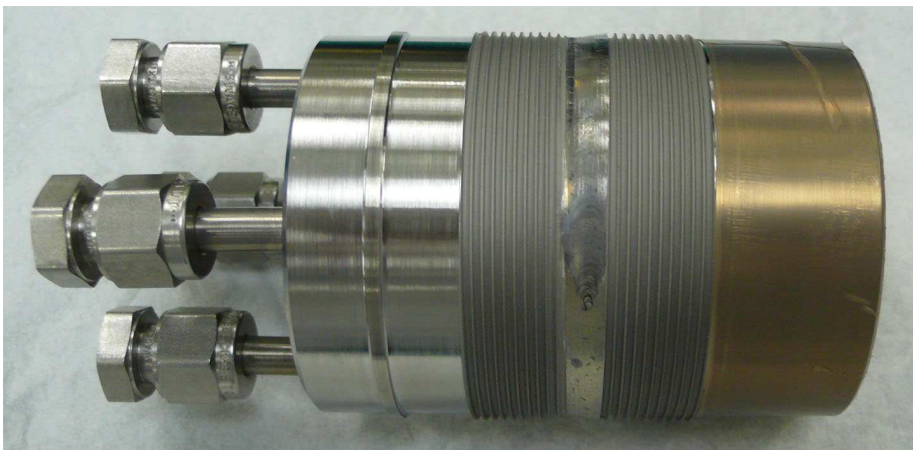
### 3 Heat eXchanger

The Heat eXchanger is part of the TTCS as shown in Figure 3-1.



**Figure 3-1: TTCS TTCS**

The Heat eXchanger is depicted in Figure 3-2. The outside of the HX consist of an Inconel body with 2 grooves. Into each groove a Inconel wire heater shall be soldered.



**Figure 3-2: TTCS Heat eXchanger**





**AMS Tracker  
Thermal Control  
Subsystem**  
FM\_HX\_Start-

Pag 9 of 15  
Doc. AMSTR-NLR-PR-055  
Issu 01  
Date 25 sept 2008

## 4 Solder procedure

### 4.1 Materials needed

Heat eXchanger

Inconel heater Thermocoax alloy 600, type ZEZI 10/10-128-10/2xCM10 SPE/CEMENT8/1419 WHITE/200 mm

Solder Sn89Ag6Pb5,

Flux Lötöl ST

Hot plate  $T \approx 240\text{ }^{\circ}\text{C}$

Solder iron  $T \approx 393\text{ }^{\circ}\text{C}$

Clamp tool (AIDC)

IPA

Sandblast equipment

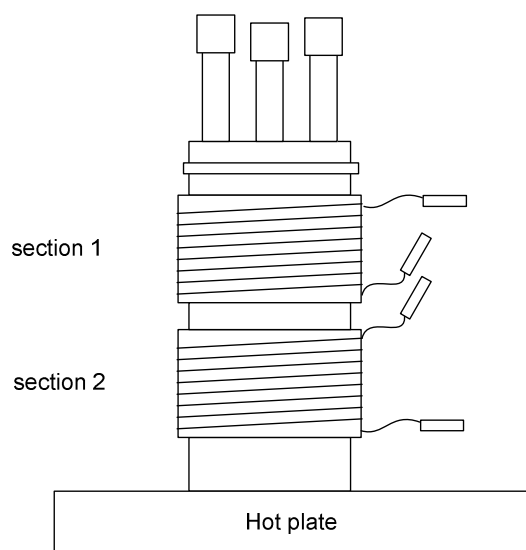
Sandpaper / Scotch Brite

### 4.2 Procedure description

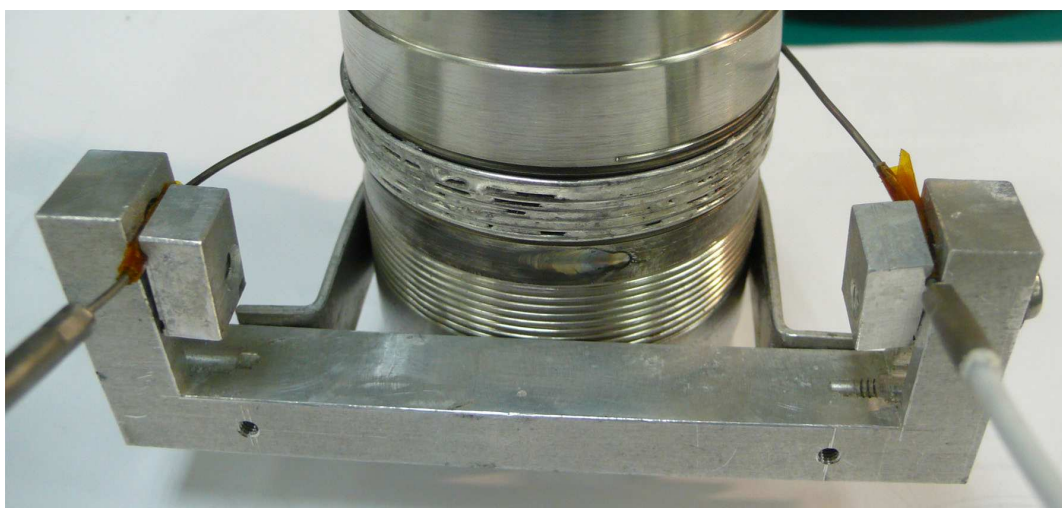
Before each solder action the surfaces must be clean. The HX shall be cleaned by sandblasting and wiping with IPA wetted tissue. During cleaning process contamination of the HX inside must be prevented, tubes shall always be closed with caps.

Two wire heaters shall be soldered to the HX, first the heater on section 1, while the grooves of section 2 are shielded with kapton tape to prevent contamination with flux and solder (see figure 4.1 HX solder set-up).

The wire heater shall be cleaned by using sandpaper and Scotch Brite, finished by wiping with IPA wetted cloth



**Figure 4-1: HX solder set-up**



**Figure 4-2: Clamp tool**



## AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-up\_heater\_soldering\_Procedure

Page	11 of 15
Doc.Id.	AMSTR-NLR-PR-055
Issue	01
Date	25 sept 2008

### 4.3 Wire heater solder procedure in steps

Test sample indication:		Test engineer:	Test Date:
Step	Action to be taken	Result	
1.	<b>Section 1</b>		
2.	Switch on hot plate, set $T \approx 240\text{ }^{\circ}\text{C}$		
3.	Measure length of wire heater and length of cold ends		
4.	Measure resistance of wire heater ( $R \approx 15\text{ }\Omega$ )		
5.	Cut thin wire $OD \leq 0.5\text{ mm}$ to length of wire heater		
6.	Sandblast HX solder section 1, protect HX other sections with tape, to prevent sandblasting total HX		
7.	Remove sand with compressed air		
8.	Clean groove with tissue and IPA		
9.	Clean wire heater with sandpaper, Scotch Brite and IPA		
10.	Use thin wire (step 3) to determine start and end position of wire heater on HX and clamp tool		
11.	Wrap wire heater in groove around HX and fix it with clamp tool, make sure hot section placed in groove		
12.	Measure resistance of wire heater ( $R \approx 15\text{ }\Omega$ )		
13.	Attach thermo couple on HX, on the weld in middle, using kapton tape		
14.	Seal/protect section 2 with kapton, to prevent contamination with flux and solder		
15.	Place HX on hot plate, if needed a heat gun can be used to assist warming up HX.		
16.	Wait till temperature measured on HX $T \approx 200\text{ }^{\circ}\text{C}$		
17.	<b>With solder iron heat a small area of wire heater + HX (hot spot)</b>		
18.	<b>Apply flux with brush on hot spot and heat area again with solder iron</b>		
19.	<b>Apply solder to heated area</b>		



## AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-up\_heater\_soldering\_Procedure

Page 12 of 15  
Doc.Id. AMSTR-NLR-PR-055  
Issue 01  
Date 25 sept 2008

Test sample indication:		Test engineer:	Test Date:
Step	Action to be taken		Result
20.	Repeat step 17..19 on area just next to previously heated area till wire heater completely soldered to HX		
21.	Slowly cool down HX, do NOT cool with water		
22.	Clean solder section with brush and IPA		
23.	Inspect joint for solder void, 'bad spot'		
24.	Repair bad spot		
25.	Place HX on hot plate		
26.	Wait till temperature measured on HX $T \approx 200\text{ }^{\circ}\text{C}$		
27.	<b>With solder iron heat a bad spot of wire heater + HX (hot spot)</b>		
28.	<b>Apply flux with brush on hot spot and heat area again with solder iron</b>		
29.	<b>Apply solder to heated area</b>		
30.	Repeat steps 27 .. 29 for all 'bad spots'		
31.	Slowly cool down HX, do NOT cool with water		
32.	Measure resistance of wire heater ( $R \approx 15\text{ }\Omega$ )		
33.	Clean solder section with brush, water and IPA		
34.	<b>Section 2</b>		
35.	Switch on hot plate, set $T \approx 250\text{ }^{\circ}\text{C}$		
36.	Measure length of wire heater and length of cold ends		
37.	Measure resistance of wire heater ( $R \approx 15\text{ }\Omega$ )		
38.	Cut thin wire $OD \leq 0.5\text{ mm}$ to length of wire heater		
39.	Sandblast HX solder section 1, protect HX other sections with tape, to prevent sandblasting total HX		
40.	Remove sand with compressed air		



## AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-up\_heater\_soldering\_Procedure

Page 13 of 15  
Doc.Id. AMSTR-NLR-PR-055  
Issue 01  
Date 25 sept 2008

Test sample indication:		Test engineer:	Test Date:
Step	Action to be taken		Result
41.	Clean groove with tissue and IPA		
42.	Clean wire heater with sandpaper, Scotch Brite and IPA		
43.	Use thin wire (step 3) to determine start and end position of wire heater on HX and clamp tool		
44.	Wrap wire heater in groove around HX and fix it with clamp tool, make sure hot section placed in groove		
45.	Measure resistance of wire heater ( $R \approx 15 \Omega$ )		
46.	Attach thermo couple on HX, on the weld in middle, using kapton tape		
47.	Place HX on hot plate, if needed a heat gun can be used to assist warming up HX		
48.	Wait till temperature measured on HX $T \approx 200 \text{ }^{\circ}\text{C}$		
49.	<b>With solder iron heat a small area of wire heater + HX (hot spot)</b>		
50.	<b>Apply flux with brush on hot spot and heat area again with solder iron</b>		
51.	<b>Apply solder to heated area</b>		
52.	Repeat step 49..51 on area just next to previously heated area till wire heater completely soldered to HX		
53.	Slowly cool down HX, do NOT cool with water		
54.	Clean solder section with brush and IPA		
55.	Inspect joint for solder void, 'bad spot'		
56.	Repair bad spot:		
57.	Place HX on hot plate		
58.	Wait till temperature measured on HX $T \approx 200 \text{ }^{\circ}\text{C}$		
59.	<b>With solder iron heat a bad spot of wire heater + HX (hot spot)</b>		
60.	<b>Apply flux with brush on hot spot and heat area again with solder iron</b>		
61.	<b>Apply solder to heated area</b>		



## AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-up\_heater\_soldering\_Procedure

Page 14 of 15  
Doc.Id. AMSTR-NLR-PR-055  
Issue 01  
Date 25 sept 2008

Test sample indication:		Test engineer:	Test Date:
Step	Action to be taken	Result	
62.	Repeat step 59 .. 61 for all 'bad spots'		
63.	Slowly cool down HX, do NOT cool with water		
64.	Measure resistance of wire heater ( $R \approx 15 \Omega$ )		
65.	Clean solder section with brush, water and IPA		



# AMS Tracker Thermal Control Subsystem

FM\_HX\_Start-

Page	15 of 15
Doc.Id	AMSTR-NLR-PR-055
Issue	01
Date	25 sept 2008

END OF DOCUMENT